

1 Underwater Pool Light

2

3 The present invention relates to an underwater pool
4 light. In particular, but not exclusively, the
5 invention relates to disposable underwater pool
6 lights for use in swimming pools and spa baths,
7 hereafter referred to as "pools".

8

9 Pools are conventionally built in one of four
10 manners. The first method is to provide two spaced
11 shutters formed from wood or steel, with steel
12 reinforcing bars arranged between the shutters.
13 Apertures are provided at a number of locations in
14 one of the shutters and a niche for the pool light
15 is located in each of the apertures. Typically, the
16 niche is positioned such that a gap exists between
17 the shutter and a flange member provided on the
18 niche. Typically, conventional niches have to be
19 modified so that they are fixed to the shutter by
20 fastening, usually by screwing, a portion of the
21 niche to the shutter. For steel shutters, which are

1 typically hired from a supplier, the cost of
2 repairing or replacing the shutter is incurred.

3

4 Cement is poured between the shutters and allowed to
5 set and then the shutters are removed. Finishers
6 are then applied to the cement wall, including
7 between the cement wall and flange of the niche.
8 The finishers comprise render, adhesive and tiling,
9 and the thickness of the finishers can range from 5
10 to 45 millimetres. It is a difficult task, given
11 this variation in thickness, for the pool builder to
12 ensure that the finishers are flush against the
13 flange member of the niche.

14

15 Another method of building the pool is to provide
16 only one shutter and the reinforcing bars. The
17 niches are suspended in position and concrete is
18 sprayed onto the shutter, and around the niches, to
19 form the concrete wall. The same problem exists for
20 the pool builder when applying the finishers to
21 ensure they are flush with the flange member of each
22 niche.

23

24 A third method of building the pool is to clamp the
25 lining of a flexible enclosure between two
26 structural layers, typically made of metal, polymer
27 or fibreglass. The two layers also clamp the flange
28 member of each niche and apertures are cut into the
29 material at each niche. A fourth method is to form
30 a fibreglass enclosure in which apertures are cut
31 for receiving each niche which is fastened to the
32 fibreglass wall at the niche flange.

1
2 Conventional pool lights do not offer a means for
3 adjusting the distance from visible parts of the
4 pool light, such as the flange member, to the wall
5 of the pool to accommodate variation in thickness of
6 the finishers. Furthermore, no pool light presently
7 exists which can be fitted to each of the four types
8 of pools described above without modification by the
9 pool builder.

10
11 Conventional pool lights use one or more separate
12 replaceable bulbs in a housing. Electrical power is
13 supplied via an insulated cable which enters the
14 housing from the niche via an aperture. The
15 aperture includes a permanent seal in order to
16 prevent water entering the housing.

17
18 The housing is cooled by the water present in the
19 space between the niche and the housing and also by
20 the water in contact with the lens at the front of
21 the housing. However, there is limited ability for
22 water to flow within the niche. This can cause the
23 accumulation of body fat from swimmers, which can be
24 a health hazard as it encourages the growth of
25 bacteria such as legionella.

26
27 When it is necessary to replace the bulb, or carry
28 out any other maintenance to the unit, the housing
29 must be removed from the niche and lifted out of the
30 water. Typically the bulb has a life of around 250
31 to 1,000 hours of use. Removal of the housing
32 typically requires the removal of a number of

1 screws, which is a difficult task to carry out
2 underwater, due to a lack of visibility and
3 mobility. The cable is typically of sufficient
4 length between the niche and the housing to allow
5 the maintenance to be carried out at the side of the
6 pool.

7
8 An improved type of pool light would comprise a
9 modular unit which includes a bulb in a cavity which
10 is enclosed by a permanently sealed body. When
11 replacement of a bulb for such a unit is necessary
12 the entire unit is replaced. This type of pool
13 light would therefore be disposable. Such a type of
14 pool light would require a wet mateable electrical
15 connection between the pool light and the power
16 cable provided in the niche. Also, fittings would
17 be required to prevent any maintenance or bulb
18 replacement from being attempted.

19
20 Conventional pool lights do not provide this wet
21 mateable connection or suitable fittings. Such pool
22 lights typically include male connectors which
23 permit electrical arcing if the pool light is
24 connected to the power cable underwater. Also, the
25 male connectors often include a guide pin which is
26 easily damaged.

27
28 It is desirable that light from the pool light can
29 project from the side wall and across at least half
30 the width of a standard training pool, as well as
31 achieving illumination of the bottom of the pool.
32 In a typical swimming pool, an individual pool light

1 may be required to illuminate an area having a
2 length of 6 metres from the unit, a width of 4
3 metres (2 metres either side of the unit) and a
4 depth of 2.4 metres from the unit to the base of the
5 pool. It is undesirable and inefficient for the
6 projected light to be projected upwards relative to
7 the base of the pool.

8
9 Conventional pool lights use a three dimensional
10 parabola shaped reflector to reflect light that is
11 projected from the bulb in a direction towards the
12 rear of the housing. Conventional lens and
13 reflector arrangements are not adapted to direct the
14 radiation of light so that there is a greater
15 proportion of radiation in a downwards direction.
16 Also, the angle of illumination, in the plane of the
17 base of the pool, is limited. Conventional lamps do
18 not significantly hinder the radiation of light in
19 an upwards direction. Dark regions can be present
20 in the pool near to the junction of the base and
21 side walls and at the side walls where the pool
22 lights are situated.

23
24 According to the present invention, there is
25 provided an underwater pool light comprising:

26 a housing;
27 a lens sealingly fixed to the housing;
28 a light source located within the housing;
29 mounting means for mounting the housing to a
30 niche within or on a wall of a pool, wherein:

1 the housing includes an integral connector for
2 external connection to an electrical supply cable,
3 and

4 the pool light includes electrical connection
5 means within the housing connecting the light source
6 to the integral connector.

7
8 Preferably the pool light includes a niche for
9 mounting the housing within or on the wall of a
10 pool.

11
12 Preferably the connector is wet mateable.

13
14 Preferably the connector includes a cable receiving
15 recess, and the recess has a keyed portion which is
16 complementary to a keyed portion provided at the
17 cable. Preferably the cable receiving recess is
18 formed by a flange projecting from the housing.

19
20 Preferably the connector comprises one or more pins
21 projecting externally from the housing and adapted
22 to engage with one or more corresponding sockets on
23 the cable. Preferably the pins project into the
24 recess. Preferably a portion of each pin is encased
25 in the housing.

26
27 Preferably the connector further comprises one or
28 more sleeves projecting externally from the housing
29 and at least partially surrounding the one or more
30 pins. The sleeves may be formed integrally with the
31 housing. Preferably the or each sleeve is made of
32 plastic or rubber.

1

2 Preferably the mounting means comprises a component
3 of the housing adapted to slideably engage with a
4 component of the niche, such that the distance
5 between the housing and the niche is selectively
6 adjustable. Preferably the pool light includes
7 clamping means for clamping the component of the
8 housing relative to the component of the niche.

9

10 Preferably the mounting means is adapted such that
11 the distance between the housing and the niche is
12 infinitely adjustable over the adjustment length.

13

14 Preferably the component of the housing comprises
15 one or more protrusions provided at the housing and
16 the component of the niche comprises one or more
17 slots provided at the niche. Preferably three
18 protrusions and three slots are provided.

19 Preferably the or each protrusion includes a keyed
20 portion which is complementary in profile to the
21 profile of the slot.

22

23 Preferably the clamping means comprises at least one
24 screw fastener.

25

26 Preferably the pool light includes a lens and the
27 component of the housing is provided at a lens
28 holding member.

29

30 Preferably the housing includes a collar projecting
31 from a face of the housing. Preferably the collar
32 has a projecting length of around 50 millimetres.

1 The collar provides an edge up to which a pool
2 builder may apply finishers to the pool wall. The
3 collar may then be trimmed.

4

5 Preferably the housing includes one or more cam
6 receiving slots, and the lens includes one or more
7 cammed members for pivotally locating the lens
8 relative to the lens holding member. Preferably two
9 cammed members are provided.

10

11 Preferably the lens includes fastener locating means
12 and a fastener for fastening the lens to the lens
13 holding member. Preferably the fastener locating
14 means comprises a hollow coned protrusion for
15 aligning the lens to a fastener receiving aperture
16 provided at the lens holding member. The cammed
17 members and fastener locating means allow self
18 alignment of the lens to the lens holding member.

19

20 Preferably the housing includes a lamp enclosure
21 which is sealably connected to the lens by a
22 plurality of fasteners. Preferably the housing
23 includes a trim guard which covers the fasteners to
24 prevent unfastening of the fasteners. Preferably
25 the trim guard includes a plurality of pegs which
26 are received in apertures provided at the lens. The
27 trim guard prevents removal of the lens for
28 replacement of the bulb or other maintenance of the
29 pool light.

30

31 Preferably the housing includes two or more openings
32 for allowing the flow of water into and out of the

1 niche. Preferably the openings are provided at the
2 perimeter of the lens. Preferably the openings
3 comprise a number of cut-outs or castellations
4 provided at the perimeter of the lens.

5
6 Preferably the niche includes one or more brackets
7 for receiving one or more fastening rods, such as
8 screwed rod. Preferably the or each bracket is
9 adapted to receive one or more fastening rods of a
10 plurality of sizes. Preferably the or each bracket
11 is adapted to receive fastening rods oriented
12 vertically, horizontally, or obliquely relative to
13 the base of the pool.

14
15 Preferably the lens has a first portion adapted to
16 direct light substantially normal to the wall of the
17 pool, and a second portion adapted to direct light
18 substantially parallel to the wall of the pool, and
19 wherein the pool light further comprises:

20 a reflector located within the housing and
21 having a first portion which is substantially
22 parabolic in vertical cross section and a second
23 portion which is adapted to reflect light
24 substantially towards the second portion of the
25 lens.

26
27 Preferably the second portion of the lens is
28 provided at the internal surface of the lens.
29 Preferably the second portion of the lens comprises
30 a plurality of Fresnel members adapted to direct
31 light substantially parallel to the wall of the
32 pool. Preferably each Fresnel member includes an

1 edge adapted to bend light so that it is
2 substantially parallel to the wall of the pool. The
3 second portion of the lens may be adapted to cause
4 diffraction of light in a direction substantially
5 parallel to the wall of the pool. The second portion
6 of the lens may include a reflective surface to
7 reflect light in a direction substantially parallel
8 to the wall of the pool.

9
10 Preferably each Fresnel member is arcuate and
11 substantially concentric about the light source.
12 Preferably the second portion of the lens is adapted
13 to direct light downwards. Preferably the second
14 portion of the lens is further adapted to direct
15 light substantially horizontally in each direction.

16
17 Preferably the first portion of the reflector is
18 substantially linear in horizontal cross section.

19
20 Preferably the second portion of the reflector has a
21 planar surface oriented to reflect light
22 substantially towards the second portion of the
23 lens. Preferably the second portion of the
24 reflector is provided at an upper region of the
25 reflector.

26
27 Preferably the reflector includes a third portion
28 which is adapted to reflect light substantially
29 towards the second portion of the lens. Preferably
30 the third portion of the reflector has a planar
31 surface. Preferably the third portion of the
32 reflector is provided at each side of the reflector.

1

2 Preferably the pool light further comprises a
3 shading member adapted to inhibit the radiation of
4 light in at least one direction. Preferably the
5 shading member is adapted to inhibit the radiation
6 of light in an upwards direction.

7

8 Preferably the shading member is positioned at the
9 external surface of the lens. Alternatively the
10 shading member is positioned at the internal surface
11 of the lens. Preferably the shading member is press
12 fit to the lens or housing.

13

14 Preferably the shading member is positioned at an
15 upper portion of the lens relative to the base of
16 the pool. Preferably the shading member is
17 substantially oval.

18

19 An embodiment of the present invention will now be
20 described, by way of example only, with reference to
21 the accompanying drawings, in which:

22

23 Fig. 1 is a side view of a pool light;

24

25 Fig. 2 is a front view of the pool light of Fig. 1;

26

27 Fig. 3 is a perspective exploded view of the pool
28 light of Fig. 1;

29

30 Fig. 4 is a perspective front view of a lens of the
31 pool light of Fig. 1;

32

1 Fig. 5 is a perspective rear view of the lens of
2 Fig. 4;

3
4 Fig. 6 is diagrammatic side view of the pool light
5 of Fig. 1;

6
7 Fig. 7 is the diagrammatic view of Fig. 6 showing
8 the radiation of light;

9
10 Fig. 8 is a diagrammatic plan view of the pool light
11 of Fig. 1;

12
13 Fig. 9 is the diagrammatic view of Fig. 8 showing
14 the radiation of light;

15
16 Fig. 10 is a perspective view of a reflector of the
17 pool light of Fig. 1;

18
19 Fig. 11 is a perspective front view of a bezel of
20 the pool light of Fig. 1;

21
22 Fig. 12 is a perspective rear view of the bezel of
23 Fig. 11;

24
25 Fig. 13 is perspective front view of a niche of the
26 pool light of Fig. 1;

27
28 Fig 14 is a perspective rear view of a housing of
29 the pool light of Fig. 1;

30
31 Fig 15 is a perspective front view of a housing of
32 the pool light of Fig. 1;

1

2 Fig 16 is a sectional side view of a housing of the
3 pool light of Fig. 1;

4

5 Fig 17 is a sectional plan view of a housing of the
6 pool light of Fig. 1;

7

8 Fig 18 is a perspective view of a supply cable of
9 the pool light of Fig. 1;

10

11 Fig 19 is a sectional side view of the pool light of
12 Fig. 1; and

13

14 Fig 20 is a perspective rear view of the niche of
15 Fig. 13.

16

17 Referring to Figs. 1 to 3 there is shown a pool
18 light 10 comprising a housing 20 which has a opening
19 that is covered by a lens 30. A reflector 40 and a
20 light source in the form of two bulbs 50 are housed
21 within the housing 20. A trim guard 60 is fitted to
22 the lens 30.

23

24 The housing includes a lamp enclosure 70 and lens
25 holding member, or bezel 80, which is sealably
26 connected to the lamp enclosure 70 using a number of
27 gaskets 90.

28

29 A collar (not shown) may be provided as projecting
30 from the inner circumference of the lamp enclosure
31 70. This collar, typically of 50 millimetres
32 length, provides an edge up to which a pool builder

1 may apply finishers to the pool wall. Once the
2 finishers had been applied, the collar may then be
3 trimmed so that its projecting edge is flush with
4 the pool wall.

5

6 The lamp enclosure 70 includes an electrical
7 connector 100 for connection to a power supply cable
8 110. Internal wiring (not shown) connects the
9 connector 100 to the two bulbs 50.

10

11 Fig. 5 is a rear view of the lens 30. The lens has
12 a first portion 32 adapted to direct light in a
13 direction substantially normal to the wall in which
14 the pool light 10 is fitted. This direction is
15 shown in Fig. 1 and is denoted as direction 'A'.
16 The lens 30 also has a second portion which
17 comprises a number of Fresnel members 34 which are
18 adapted to direct light substantially parallel to
19 the wall of the pool. This direction may be
20 downwards which is shown in Figs. 1 and 2 as
21 direction 'B'. The direction of light from the
22 Fresnel members 34 may also be horizontal which is
23 shown in Fig. 2 as direction 'C'. The direction of
24 light may also be at an oblique angle lying anywhere
25 between directions 'B' and 'C'. The Fresnel members
26 34 are all provided within a lower region of lens
27 30, and are arcuate and concentric about the bulbs
28 50. Each Fresnel member 34 includes an edge 36
29 which is adapted to bend light so that it is
30 parallel to the pool wall.

31

1 Light may reach the lens 30 directly from the bulbs
2 50 or it may be reflected from the reflector 40.
3 The reflector 40 is shown in Fig. 10, and its
4 sectional profile is shown in Figs. 6 to 9. The
5 reflector 40 has a first portion 42 which is
6 substantially parabolic in vertical cross section
7 and so reflects light in a direction substantially
8 normal to the pool wall. The reflector 40 also has
9 a second portion 44 which has a planer surface and
10 is oriented to reflect light substantially towards
11 the Fresnel members 34. Fig. 7 shows that a
12 substantial amount of light is radiated in a
13 direction normal to the pool wall. A significant
14 proportion of light is also radiated downwards.
15
16 As shown in Fig. 8, the first portion of the
17 reflector is linear in horizontal cross section,
18 rather than parabolic. The reflector 40 also
19 includes a third portion 46 which has a planar
20 surface and is oriented to direct light to the
21 Fresnel members 34 so that the light is directed
22 horizontally and parallel to the wall of the pool.
23 The radiation of light can be seen in Fig. 9, and it
24 can be seen that a significant proportion of light
25 is radiated in a substantially horizontal direction.
26
27 It is to be understood that the reflector 40 and
28 Fresnel members 34 co-operate to provide a
29 significant portion of light being directed in a
30 direction parallel to the pool wall and that, if
31 either feature were used individually, the effect
32 would not be significant.

1

2 The reflector is typically made from aluminium.
3 Fig. 10 shows that an 'S' shape is stamped through
4 the reflector wall at each side at a position near
5 to the bulbs 50. This allows folding of the
6 material within the 'S' shape to produce two legs to
7 hold each bulb 50 while providing an aperture for
8 receiving each bulb 50 and allowing access to
9 electrical wiring.

10

11 As seen in Fig. 2, the trim guard 60 includes a
12 shading member 62 positioned at an upper region of
13 the lens 30. The shading member 62 is oval and
14 opaque and so inhibits the radiation of light in an
15 upwards direction.

16

17 Referring to Fig. 4, the trim guard 60 is fitted to
18 the lens 30 using alternate holes 38 provided in the
19 lens 30. The rear of the trim guard 60 includes
20 pegs (not shown) for press fitting into the holes
21 38. The remaining holes 39 of the lens 30 are used
22 for connection of the lens 32 to the lamp enclosure
23 70.

24

25 The pool light 10 includes a niche 120 for mounting
26 the pool light 10 within the wall of the pool.
27 Mounting means are provided for mounting the housing
28 20 to the niche 120. The mounting means comprises a
29 component of the housing, in the form of three
30 protrusions 82 provided at the rear of the bezel 80,
31 which are adapted to slidably engage with a
32 component of the niche, in the form of corresponding

1 slots 122 provided at the niche 120. The bezel 80
2 and niche 120 are shown in Figs. 11 to 13. The
3 mounting means allows the distance between the
4 housing 20 and niche 120 to be selectively adjusted.
5 Clamping means, in the form of screw fasteners (not
6 shown) are provided for clamping the protrusions 82
7 at the selected position in the slots 122.

8
9 The bezel 80 includes two cam receiving slots 84 (as
10 shown in Fig. 11) for receiving the cammed members
11 86 provided at the lens 30 (as shown in Fig. 4).
12 The lens 30 may conveniently be fitted to the bezel
13 80 by locating the cammed members 86 in the cam
14 receiving slots 84 and pivoting the upper region of
15 the lens 30 towards the bezel 80. The lens 30
16 includes fastener locating means in the form of a
17 hollow coned protrusion 24 provided at the rear of
18 the lens 30. The coned profile of the protrusion 24
19 assists to align the protrusion 24 in a fastener
20 receiving aperture 88. A fastener such as a screw
21 (not shown) may be inserted through the coned
22 protrusion 24 and screwed within the aperture 88 to
23 hold the lens 30 to the bezel 80. The cammed
24 members 86, fastener locating means, and the use of
25 only one fastener allow easier aligning and
26 fastening of the lens 30 to the bezel 80.

27
28 Fig. 4 shows that the lens 30 includes a number of
29 openings or castlations 26 provided at the perimeter
30 of the lens 30. These castlations 26 allow the flow
31 of water into and out of the niche 120.

32

1 Figs. 14 to 17 show the electrical connector 100 of
2 the housing 20 for connection to a power supply
3 cable 110, a portion of which is shown in Fig. 18.
4 The connector is wet mateable in the sense that the
5 pool light 10 may be connected to the power cable
6 110 under water.

7
8 The connector 100 includes two terminal pins 106,
9 each partially enclosed by a sleeve 108 formed from
10 an electrically non-conducting material, such as
11 plastic. The pins 106 and sleeves 108 are
12 permanently fixed within apertures 109 provided in
13 the housing 20. Any suitable fixing means can be
14 used providing that water is not able to enter the
15 housing 20 via the apertures. In the illustrated
16 embodiment, the pins 106 and sleeves 108 are moulded
17 into the housing. Wiring (not shown) is used to
18 connect the exposed end of each pin 106 to the bulbs
19 50.

20
21 The supply cable 110 includes two sockets 114 which
22 receive the other end of the pins 106 within the
23 sleeves 108 to form an electrical connection when
24 the pins 106 have been fully received. The close
25 fitting of the sleeves 108 to the sockets 114 causes
26 water to be expelled from the sockets 114. The
27 other end of the cable 110 is permanently fixed to a
28 second connector 130 provided at one of two cable
29 entry ports 132 provided in the niche 120. A
30 further supply cable (not shown) connects the second
31 connector 130 to the power supply.

32

1 The connector 100 includes a cable receiving recess
2 102. This recess 102 includes a keyed portion 104
3 which is complementary to a keyed portion 112 of the
4 cable 110. These keyed portions 104, 112 permit
5 insertion of the cable 110 into the recess 102 in
6 one orientation only, thereby ensuring correct
7 insertion of the cable 110.

8
9 Fig. 19 shows the pool light 10 within the niche
10 120. The pool light 10 can be removed a short
11 distance from the niche 120 and then disconnected
12 from the supply cable 110 while still underwater.
13 Therefore, only a short length of cable 110 need be
14 accommodated between the housing 20 and niche 120.
15 The L shape of one end of the cable 110 also assists
16 in accommodating the cable 110.

17
18 Fig. 20 shows that the niche 120 includes a number
19 of brackets 124 for receiving fastening rods, such
20 as screwed rod 126. The screwed rod 126 is
21 typically of the standard size such as M6 or M8, and
22 the brackets are adapted to receive more than one
23 size of screwed rod 126. The brackets 124 are
24 adapted to receive screwed rod 126 which is
25 vertically or horizontally oriented. This allows
26 the vertical position of the pool light 10 to be set
27 during installation.

28
29 The present invention may be used for any of the
30 four methods of pool building without any further
31 modification.

32

1 Various modifications and improvements can be made
2 without departing from the scope of the present
3 invention.

4

5